Breaking the Chains of Correlation: The Hammer Strikes Back*

FB, JS, MW, MZ

April 1st, 2023

1 Hammers & Causality

Hammers date back as far as 3.3 million years [Hovers, 2015] and have proven to be a reliable tool throughout the ages. In the face of today's ongoing digitalization hammers are matched with their virtual counterparts and have proven to be as reliable as a digital tool as they are in their physical form. In particular the field of causality [Pearl, 2009] has recognized the great potential of digital hammers to manipulate graph structures. When we perform an intervention on a variable of interest within our graph, then we do so to ultimately discover how this intervention will affect downstream graph nodes. By observing changes, we actually observe how our intervened variable *causes* the affected nodes (also known as effects). Put metaphorically, if our current belief about two variables that are correlated is being altered through the intervention, then we can portray this as a "hammer striking through the chains" of correlation that hold back our insight on the underlying causation.

2 The Right Choice of Tool

"Not all hammers are created equal," goes a famous saying likely to be attributed to either an elderly scholar from ancient Greece or your local handyman. The gist of it: work related to hammers often requires precise handling rather than raw strength. The right technique for effective intervention on the system under consideration seems to be an important skill, both on- and offline, and is sometimes considered to be mission-critical [Warde, 1992]. Other tools often appearing in temporal or spacial proximity to hammers include amongst others pliers, chisels and nails. As researchers interested in causality and its application to intelligent systems, we want to bridge the gap between common practices in craftsmanship that involve the usage of the "right tool at the right time" and ongoing practices by causality researchers that seem to treat their 'hammers' as universal problem-solving tools. We strongly fear that researchers in causality have fallen victim to Maslow's law of the hammer Maslow [1966], Wikipedia [2023b].[1] Therefore, we propose the following new hammer

---

*This title was suggested by ChatGPT [OpenAI, 2022] and is totally not a reference to StarWars (`https://www.imdb.com/title/tt0080684/`) and Pokémon (`https://www.imdb.com/title/tt0190641/`). We conjecture this to be more than mere correlation.

[1]In summary, the thesis that became a law states that "If your only tool is a hammer, it is tempting to treat everything as if it were a nail."

variations to help researchers in causality become more professional by equipping them with suitable tools, just like craftsman. Our proposed tools are:

Mario's Hammer[2]: This all-rounder comes in handy for all sorts of tasks, but not just that. Due to its elegant shape, it is most popular amongst researchers in the field of causality. The hammer allows you to indicate that an intervention is in-place.

Ball-Peen Hammer: This hammer offers higher fidelity compared to the previous one. It can not only indicate but also *describe* the actual parameters of the intervention.

Sledge Hammer: Have you ever been in a nerve-wrecking situation, where you wanted more than mere intervention? Then this hammer is the one for you as it will satisfy your violent intentions. This crude hammer allows you to alter the very fabric of the intervened variable. Warning: might render the variable latent or even delete it!

Carpenter Hammer: Your parents favorite hammer! Talking about parents: this hammer allows you to alter the specification of the causal mechanism without having to switch the parents.

Rubber Mallet: Not to be confused with the 90's craze around the *mullet* haircut. Medical doctors have been using this hammer for centuries to poke their patients' knees [Lanska and Lanska, 1990]. Only safe for use with *soft* interventions.

HAM-mer: We really have no clue why one would need such an abomination of a hammer. While blindly stumbling through AI generated proposals on different types of hammers, this one eventually made it into our list. Ironically, the authors are mostly vegetarian.

RAM-mer: This hammer is futuristic! It allows you to save the value of one node and insert it into another. Particularly useful, if you do not know which exact intervention value is needed a-priori.

---

[2]The japanese-born, italian plumber is notoriously known for being an 'all-rounder' throughout various video game installments [Reddit, 2019].

Rammer: Not to be confused with the *RAM-mer*. This animalistic hammer seems as if it were possessed by the spirit of a never-stopping, wild animal. It is most useful in the cases where you need to intervene on more than one variable. But there is another, non-causal use-case for this particular hammer. Imagine that you have a lazy friend who was bestowed upon with a great and motivating boss at work. Unfortunately, your own boss does not even know you exist. You feel sad, your friend feels lucky—and to be honest, we both know that only *you* deserve the recognition. The Rammer allows you to take out excessive anger by shoving it into ███████████████. All of a sudden, you get the praise you always knew you deserved. We are so proud of you!

2.1 Impact on Causality Research

By conducting a qualitative evaluation in the form of a meta-review on related literature in causality research, the authors hereby confirm the successful application of various hammers on causal graphs. To mention a select few, consider for example the Figures 1 in [Schölkopf et al., 2021], [Peters et al., 2016], [Zečević et al., 2021], [Tigas et al., 2022], and [Willig et al., 2021] respectively. While the idea of an intervention (as driving motor for causation) is older than any of the popular, formal frameworks such as the one by [Pearl, 2009]—consider [Reutlinger, 2013] for a discussion on various competing interventionist theories of causation—the original first-time use of the hammer *metaphor* seems to have had made its debut in [Peters et al., 2016].

2.2 Ethical and Societal Considerations

Potential dangers may arise from the unsafe use of hammers. Luckily, activities such as *throwing hammers* [Wikipedia, 2023c] are only practiced by small groups of people, thereby reducing the overall societal risk. In the greater scheme of things, society as a whole literally builds upon these tools. Much like causality research, which advances one swing at a time. We hope that our contribution, in providing the 'right' tools for work (in the craft around cause and effect), sets the right playing ground for further achievements down the line. Actually, we are optimistic that many breakthroughs will follow in the future as long as they make sure *not to remain invariant to the choice of the hammer*.

Disclaimer: while this paper does not meet regular scientific standards, and while it is clearly an April Fools' joke Wikipedia [2023a], we actually believe that using different depictions of hammers could help causality research in indicating more easily *what definition of intervention* is currently being employed. Happy 1st of April!

The authors: FB = Florian Peter Busch, JS = Jonas Seng, MW = Moritz Willig, MZ = Matej Zečević

References

Erella Hovers. Tools go back in time. *Nature*, 521(7552):294–295, 2015.

DJ Lanska and MJ Lanska. John madison taylor (1855-1931) and the first reflex hammer. *Journal of Child neurology*, 5(1):38–39, 1990.

Abraham Harold Maslow. The psychology of science a reconnaissance. 1966.

OpenAI. OpenAI ChatGPT. `https://openai.com/blog/chatgpt`, 2022. Accessed: 2023-04-01.

Judea Pearl. *Causality*. Cambridge university press, 2009.

J. Peters, P. Bühlmann, and N. Meinshausen. Causal inference using invariant prediction: identification and confidence intervals. *Journal of the Royal Statistical Society, Series B (Statistical Methodology)*, 78(5): 947–1012, 2016. doi: 10.1111/rssb.12167. URL `http://arxiv.org/abs/1501.01332`. (with discussion).

Reddit. Aside from mario, who are other all-rounders? `https://www.reddit.com/r/smashbros/comments/a76kmq/aside_from_mario_who_are_other_allrounders/`, 2019. Accessed: 2023-04-01.

Alexander Reutlinger. The interventionist theory of causation. In *A theory of causation in the social and biological sciences*, pages 25–70. Springer, 2013.

Bernhard Schölkopf, Francesco Locatello, Stefan Bauer, Nan Rosemary Ke, Nal Kalchbrenner, Anirudh Goyal, and Yoshua Bengio. Toward causal representation learning. *Proceedings of the IEEE*, 109(5): 612–634, 2021. doi: 10.1109/JPROC.2021.3058954.

Panagiotis Tigas, Yashas Annadani, Andrew Jesson, Bernhard Schölkopf, Yarin Gal, and Stefan Bauer. Interventions, where and how? experimental design for causal models at scale. In *Advances in Neural Information Processing Systems*, volume 35, pages 24130–24143. Curran Associates, Inc., 2022. URL `https://proceedings.neurips.cc/paper_files/paper/2022/file/98a5c0470e57d518ade4e56c6ee0b363-Paper-Conference.pdf`.

John Warde. Using correct hammer to nail things down. `https://www.nytimes.com/1992/03/08/nyregion/home-clinic-using-correct-hammer-to-nail-things-down.html`, 1992. Accessed: 2023-04-01.

Wikipedia. April fools' day. `https://en.wikipedia.org/wiki/April_Fools%27_Day`, 2023a. Accessed: 2023-04-01.

Wikipedia. Law of the instrument. `https://en.wikipedia.org/wiki/Law_of_the_instrument`, 2023b. Accessed: 2023-04-01.

Wikipedia. Hammer throw. `https://en.wikipedia.org/wiki/Hammer_throw`, 2023c. Accessed: 2023-04-01.

Moritz Willig, Matej Zečević, Devendra Singh Dhami, and Kristian Kersting. The causal loss: Driving correlation to imply causation. *arXiv preprint arXiv:2110.12066*, 2021.

Matej Zečević, Devendra Dhami, Athresh Karanam, Sriraam Natarajan, and Kristian Kersting. Interventional sum-product networks: Causal inference with tractable probabilistic models. In *Advances in Neural Information Processing Systems*, volume 34, pages 15019–15031. Curran Associates, Inc., 2021. URL `https://proceedings.neurips.cc/paper_files/paper/2021/file/7eb7eabbe9bd03c2fc99881d04da9cbd-Paper.pdf`.

[3]

---

[3]Some icons for the various hammer depictions are taken from `https://www.svgrepo.com/`.